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L2: Entry 3 of 8 File: USPT Jun 5, 2001

DOCUMENT-IDENTIFIER: US 6241281 B1
TITLE: Metal complexes for use as gas generants

Brief Summary Text (63):
In addition, a substance such as guanidine nitrate may also have some oxidizing capacity because of the presence of, for example, the nitrate group. However, the cool burning organic nitrogen compound is not the principle oxidizing agent. It may, however, act as a secondary oxidizing agent or a co-oxidizer together with other oxidizing or co-oxidizing substances noted above such as, for example, basic copper nitrate.

Brief Summary Text (67):
In this preferred embodiment, preferred gas generant compositions comprise cool burning organic nitrogen compounds, and in addition, also comprise: 1) at least one one primary fuel such as a metal complex like, for example, hexamminecoabalt nitrate, Co(NH.sub.3).sub.6 (NO.sub.3).sub.3, which is different than the cool burning organic nitrogen compound, 2) a co-oxidizer such as, for example, basic copper nitrate, Cu.sub.2 (OH).sub.3 NO.sub.3, which is different than the cool burning organic nitrogen compound, and 3) a binder which is preferably a water soluble binder such as, for example, guar gum.

Brief Summary Text (68):
In general, in this preferred embodiment, fuels, co-oxidizers, and binders can be used which have previously been described herein. However, preferred examples of fuels for this preferred embodiment include cobalt ammine complexes, and hexaammincobalt nitrate is particularly preferred. Preferred examples of co-oxidizer include basic metal carbonates, basic metal nitrates, metal oxides, metal nitrates, and metal hydroxides. Basic copper nitrate is particularly preferred. Preferred examples of binders include water soluble or substantially water soluble polymers including gums. Guar gum is particularly preferred.

Brief Summary Text (71):
The cool burning organic nitrogen compound can be used to replace partially the fuel ingredient. In this case, the amount of co-oxidizer can be increased to maintain the desired stoichiometry. This may result in cost savings because, for example, both basic copper nitrate and guanidine nitrate are significantly less costly than hexamminecobalt nitrate. Surprisingly, however, the overall performance of the generant is maintained despite the replacement. The maintenance of overall performance is achieved from a volume perspective because the density of the mixture increases as the relative proportion of basic copper nitrate increases.

Detailed Description Text (73):
A formulation was prepared comprising the following starting ingredients: 1) 72.84 wt. % cobalthexaammine nitrate, 2) 21.5 wt. % basic copper nitrate, 3) 5.0 wt. % guar gum, and 4) 0.66 wt. % carbon.

Detailed Description Text (76):
A formulated blend to be extruded was prepared comprising: 1) 38.75 wt. % basic copper nitrate, 2) 36.38 wt. % hexaaminecobaltnitrate, 3) 19.5 wt. % guanidine nitrate, 4) 5.0 wt. % guar gum, and 5) 0.37 wt. % carbon black. The blend was prepared by mixing the ingredients according to the procedure described in Example 33.

Detailed Description Text (79):
A formulated blend to be extruded was prepared comprising: 1) 40.34 wt. % basic copper nitrate, 2) 37.86 wt. % hexaaminecobaltnitrate, 3) 15.8 wt. % guanidine nitrate, 4) 5.7

wt. % guar gum, and 5) 0.3 wt. % carbon black. The blend was prepared by mixing the ingredients according to the procedure described in Examples 33 and 34. Results comparable to those of Example 34 were expected and obtained.

Current US Original Classification (1):
280/741

L2: Entry 4 of 8 File: USPT Dec 5, 2000

DOCUMENT-IDENTIFIER: US 6156137 A
TITLE: Gas generative compositions

Abstract Text (1):
Gas generative compositions especially useful in inflators for protective passive restraint devices (e.g., motor vehicle air bags, escape slide chutes, lift rafts, and the like) include a nitrogen-containing fuel and an oxidizer selected from copper (II) oxide (CuO), cupric nitrate, basic copper nitrate (Cu(NO.sub.3).sub.2.3Cu(OH.sub.2), strontium nitrate (Sr(NO.sub.3).sub.2) and mixtures thereof. Most preferably the nitrogen-containing fuel is azodicarbonamidine dinitrate (AZODN) and/or 2,4,6,8,10,12-hexanitro-2,4,6,8,10,12-hexaazaisowurtzitane (CL-20). The compositions of the present invention provide high burning rates with acceptable burning rate pressure exponents which allow their operation at lower pressures, thereby resulting in the use of less costly, lower weight, and lower strength materials for design and manufacture of the inflator pressure vessel.

Brief Summary Text (7):
Broadly, the present invention is directed toward gas generative compositions which exhibit low concentrations of insoluble combustion products. In this regard, the gas generative compositions of the present invention are embodied in a solid mixture of a nitrogen-containing fuel and an oxidizer selected from oxides of copper, nitrates of copper and strontium, and mixtures thereof. Most preferably, the nitrogen-containing fuel is azodicarbonamidine dinitrate (AZODN) and/or 2,4,6,8,10,12-hexanitro-2,4,6,8,10,12-hexaazaisowurtzitane, colloquially known in the art as "CL-20". The oxidizer is most preferably copper (II) oxide (CuO) and/or basic copper nitrate (also known as copper trihydroxynitrate (Cu(NO.sub.3)hd 2.3Cu(OH.sub.2) and/or strontium nitrate (Sr(NO.sub.3).sub.2).

Brief Summary Text (8):
It has been discovered that the compositions of the present invention provide high burning rates with acceptable burning rate pressure exponents which allow their operation at lower pressures, thereby resulting in the use of less costly, lower weight, and lower strength materials for design and manufacture of the inflator pressure vessel. In accordance with this invention, the use of nitrate and perchlorate salts of azodicarbonamidine, and in particular azodicarbonamidine dinitrate, or hexanitrohexaazaisowurtzitane (CL-20) and mixtures thereof, in combination with oxidizers such as copper oxide, basic copper nitrate, strontium nitrate or mixtures thereof, and optionally a binder for providing structural integrity, results in heterogeneous propellant compositions which provide greater total gas output and a lower concentration of insoluble solid combustion products, than when such oxidizers are used with prior art fuels such as guanidine nitrate, aminoguanidine nitrate, nitroguanidine, ethylenediamine dinitrate, cyclotrimethylenetrinitramine (RDX), cyclotetramethylenetetranitramine (HMX), and various tetrazole derivatives, such as 5-aminotetrazole, diammonium bitetrazole, and potassium 5-aminotetrazole.

Detailed Description Text (3):
The compositions of the present invention will also contain an oxidizer selected from copper (II) oxide (CuO), cupric nitrate, basic copper nitrate (Cu(NO.sub.3).sub.2.3)Cu(OH).sub.2), strontium nitrate (Sr(NO.sub.3).sub.2) and mixtures thereof. The oxidizer will be present in the compositions of this invention in an amount between about 10 wt. % to about 60 wt. %, and more preferably between about 20 wt. % to about 60 wt. %.

Detailed Description Text (12):
Basic copper nitrate (copper trihydroxy nitrate) was combined with each of the fuel

components noted below in Table 1 to obtain binary compositions. Theoretical calculations were conducted for the binary compositions of Table 1 at a combustion pressure of 5000 psia and an oxidation ratio of 0.95. The results are summarized in Table 1.

Detailed Description Paragraph Table (2):
TABLE 2 COMPOSITION AND PROPERTIES OF HIGH BURNING RATE AZODN GAS GENERATOR PROPELLANTS C1 C2 C3 Composition, Wt % Azodicarbonamidine 68.66 60.15 67.00 Dinitrate Strontium Nitrate 28.34 -- -- Copper (II) Oxide -- 39.85 -- Basic Copper Nitrate -- -- 31.00 Polyalkylene 3.00 -- 2.00 Carbonate Binder Combustion Products: Gaseous Reaction 83.70 72.30 83.00 Products Moles of Gas per 3.5 2.7 3.1 100 gms: Solid Reaction 16.30 27.70 17.00 Products: Ballistic Properties: Burning Rate, 0.50 0.80 0.64 1000 psi, ips Pressure Exponent, n: 0.48 0.63 0.51 Pellet Crush Strength Studies: Baseline, stress, psi: 3948 -- 3827 Age at 107.degree. C., 3107 3703 -- 400 Hrs, psi Temp. Cycling, 5258 4082 -- 200 cycles, - 40/107.degree. C., psi Hazards Properties: Threshold Green Line Green Line Green Line Impact: >45 kgcm >50 kgcm >45 kgcm Friction, ABL: Neg > 100 psi Neg > 1800 psi Neg > 100 psi @90.degree. @90.degree. @90.degree. Electrostatic Neg > 1.4 Neg > 6 Neg > 1.4 Discharge; Joules Joules Joules

Current US Cross Reference Classification (4):
280/740

Current US Cross Reference Classification (5):
280/741

CLAIMS:

1. A gas generative composition which comprises a solid mixture of a nitrogen-containing fuel comprising azodicarbonamidine dinitrate and an oxidizer selected from copper (II) oxide, cupric nitrate, basic copper nitrate, strontium nitrate, and mixtures thereof.

11. A gas generative composition comprising a solid mixture of:

between about 50 to about 90 wt. % of azodicarbonamidine dinitrate;

between about 20 to about 60 wt. % of an oxidizer which is at least one selected from the group consisting of copper (II) oxide, cupric nitrate, basic copper nitrate and strontium nitrate; and

between about 1.0 to about 6.0 wt. % of a poly(alkylene carbonate) binder material.

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L2: Entry 6 of 8 File: USPT Apr 18, 2000

DOCUMENT-IDENTIFIER: US 6051158 A
TITLE: Treatment of airbag inflation gases

Brief Summary Text (41):
Oxidizers for use in such extrudable chemical coolant formulations include: alkali metal nitrates, chlorates and perchlorates; alkaline earth metal nitrates, chlorates and perchlorates; CuO; Fe.sub.2 O.sub.3 ; CoO; Co.sub.3 O.sub.4 ; V.sub.2 O.sub.5 ; ammonium nitrate; ammonium perchlorate; basic copper nitrate; and mixtures thereof.

Current US Cross Reference Classification (5):
280/728.1

CLAIMS:

4. The chemical coolant material of claim 3 wherein said oxidizer is selected from the group consisting of: alkali metal nitrates, chlorates and perchlorates; alkaline earth metal nitrates, chlorates and perchlorates; CuO; Fe.sub.2 O.sub.3 ; CoO; Co.sub.3 O.sub.4 ; V.sub.2 O.sub.5 ; ammonium nitrate; ammonium perchlorate; basic copper nitrate; and mixtures thereof.

16. The extruded chemical coolant material of claim 15 wherein said oxidizer is selected from the group consisting of: alkali metal nitrates, chlorates and perchlorates; alkaline earth metal nitrates, chlorates and perchlorates; CuO; Fe.sub.2 O.sub.3 ; CoO; Co.sub.3 O.sub.4 ; V.sub.2 O.sub.5 ; ammonium nitrate; ammonium perchlorate; basic copper nitrate; and mixtures thereof.

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L2: Entry 7 of 8 File: USPT Nov 9, 1999

DOCUMENT-IDENTIFIER: US 5979936 A
TITLE: Airbag inflator

Detailed Description Text (30):
The use of an oxygen-including thermoplastic material such polyethylene glycol can be particularly advantageous. The additional oxygen included in the fuel material can be useful in improving the reaction rate so that proper combustion of the fuel material occurs within the short period of time provided for inflation of an airbag cushion. It will be appreciated that such a preferred type of fuel material can, if desired, be in the form of a monolithic solid grain or a quantity of extruded pellets. Further, such materials can typically be easily made via low-cost extrusion processing. Still further and if desired, additional oxidizer compounds such as potassium perchlorate, basic copper nitrate, etc., can be easily added during extrusion processing to enhance the reaction rate. Typically such additional oxidizer compounds, if added, are added in relatively low levels such that the final formulation is a mixture of fuel and oxidizer which remains fuel-rich and thus requires additional oxygen provided by the nitrous oxide to complete combustion.

Current US Original Classification (1):
280/736

Current US Cross Reference Classification (1):
280/737

Current US Cross Reference Classification (2):
280/741

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L2: Entry 8 of 8 File: USPT Mar 16, 1999

DOCUMENT-IDENTIFIER: US 5882036 A
TITLE: Hybrid inflator with reduced solid emissions

Detailed Description Text (18):
21.5% copper (III) trihydroxynitrate (also known as basic copper nitrate)

Detailed Description Text (21):
40.3% copper (III) trihydroxynitrate (also known as basic copper nitrate)

Current US Original Classification (1):
280/736

Current US Cross Reference Classification (3):
280/737

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L5: Entry 2 of 8 File: USPT Mar 5, 2002

DOCUMENT-IDENTIFIER: US 6352030 B1
TITLE: Gas generating eject motor

Detailed Description Text (4):
Gas generant material compositions that are suitable for use in this application are described in, for example, U.S. Pat. No. 5,725,699 and U.S. Pat. No. 5,592,812, the respective disclosures of which are hereby incorporated by reference. For proof of concept testing, the present inventors have used a gas generant composition of 4 wt % polyacrylamide (PAM), 23 wt % basic copper nitrate (BCN), and 73 wt % hexammine cobalt (III) nitrate (HACN).

CLAIMS:

3. The eject motor of claim 1, wherein said ignitable gas generant comprises a composition of polyacrylamide, basic copper nitrate, and hexammine cobalt (III) nitrate.

4. The eject motor of claim 3, wherein said ignitable gas generant comprises a composition of 4 wt % 2 polyacrylamide, 23 wt % basic copper nitrate, and 73 wt % hexammine cobalt (III) nitrate.

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L4: Entry 4 of 16 File: USPT Nov 5, 2002

DOCUMENT-IDENTIFIER: US 6475312 B1
TITLE: Method of formulating a gas generant composition

Brief Summary Text (16):
The above-referenced problems are reconciled by compositions containing 5-aminotetrazole nitrate (5ATN) as a fuel at about 25-100% by weight of the total composition. An oxidizer is selected from a group of compounds including phase stabilized ammonium nitrate, ammonium nitrate, potassium nitrate, strontium nitrate, copper dioxide, and basic copper nitrate. Other oxidizers well known in the art are also contemplated. These generally include but are not limited to inorganic oxidizers such as alkali and alkaline earth metal nitrates, nitrites, chlorates, chlorites, perchlorates, and oxides.

Current US Original Classification (1):
149/109.6

Current US Cross Reference Classification (1):
149/46

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L4: Entry 5 of 16 File: USPT Jan 1, 2002

DOCUMENT-IDENTIFIER: US 6334961 B1
TITLE: Low ash gas generant and ignition compositions for vehicle occupant passive restraint systems

Brief Summary Text (15):
The oxidizer will be present in amounts between about 10 wt % to about 60 wt %, and most preferrably between about 25 wt % to about 45 wt. %. According to the present invention, the preferred oxidizer is a nitrate salt of strontium, copper, or cerium, including complex nitrate salts of either copper or cerium. Specific examples of complex salts of copper and cerium include copper-amine-nitrate complexes (e.g. Cu(NH.sub.3).sub.4 NO.sub.3).sub.2), basic copper nitrate (e.g., Cu(NO.sub.3).sub.2.3[CL(OH).sub.2]), cerium ammonium nitrate (e.g., Ce(NH.sub.4).sub.2 (NO.sub.3).sub.6) and the like. Strontium nitrate and/or cerium ammonium nitrate are preferred. Potassium perchlorate (KP) may also be used either alone or in combination with the aforementioned oxidizers in order to modify the ballistics (burning rate and pressure exponent) of the invention, in which case the combined weight of KP and the other oxidizers remains in the range of 10 to 60 wt. %. Use of the preferred oxidizers in conjunction with the hot, clean nitramines described above provide a new class of clean-burning compositions suitable for use as either ignition material or as a gas generant.

Current US Cross Reference Classification (1):
149/108.2

Current US Cross Reference Classification (2):
149/19.1

Current US Cross Reference Classification (3):
149/19.5

Current US Cross Reference Classification (4):
149/19.91

Current US Cross Reference Classification (5):
149/62

Current US Cross Reference Classification (6):
149/70

Current US Cross Reference Classification (7):
149/72

WEST

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L4: Entry 7 of 16 File: USPT Nov 7, 2000

DOCUMENT-IDENTIFIER: US 6143102 A
TITLE: Burn rate-enhanced basic copper nitrate-containing gas generant compositions and methods

Abstract Text (1):
Basic copper nitrate-containing gas generant compositions and associated methods are provided for producing or resulting in increased burn rates via the inclusion of an effective amount of one or more metal (e.g., Al, Ti, Zn, Mg and/or Zr) oxide additives.

Brief Summary Text (6):
Basic copper nitrate (Cu(NO.sub.3).sub.2 .cndot.3Cu(OH).sub.2) (sometimes referred to herein by the notation "bCN") has or exhibits various properties or characteristics including, for example, high gas output, density and thermal stability and relatively low cost such as to render desirable the use or gas generant composition inclusion thereof as an oxidizer. The use of such basic copper nitrate or related materials has been the subject of various patents including Barnes et al, U.S. Pat. No. 5,608,183, issued Mar. 4, 1997 and Barnes et al, U.S. Pat. No. 5,635,688, issued Jun. 3, 1997, the disclosures of which are fully incorporated herein by reference.

Brief Summary Text (8):
A limitation on the greater or more widespread use of basic copper nitrate in such gas generant compositions is that basic copper nitrate-containing gas generant compositions may exhibit or otherwise have associated therewith undesirably low or slow burn rates. In practice, the normal or typical burn rates associated with such gas generant compositions can act to restrict the use of such gas generant compositions to those applications wherein faster burn rates are either not required or desired. For example, such low or slow burn rate compositions may be unsuited for various side impact applications where more immediate generation or supply of inflation gas may be required or desired.

Brief Summary Text (19):
Unfortunately, various basic copper nitrate-containing gas generant compositions may, upon combustion, produce or result in non-gaseous combustion products which exhibit undesirably poor slagging properties or characteristics. As a result, the use of such basic copper nitrate-containing gas generant compositions may necessitate or require the use of expensive filtration devices or techniques in or in association with corresponding inflator devices.

Brief Summary Text (20):
Thus, there is a need and a demand for gas generant compositions and related methods which while containing basic copper nitrate as a component thereof provide sufficiently high or elevated burn rates. Further, there is a need and a demand for such gas generant compositions and related methods wherein non-gaseous combustion products are of a form which permits the ready removal thereof without necessitating costly or complicated removal devices or techniques.

Brief Summary Text (26):
a basic copper nitrate oxidizer component therefor, and

Brief Summary Text (28):
The prior art generally fails to provide basic copper nitrate-containing gas generant compositions and related methods which exhibit a burn rate as high as may be desired such as for particular applications. In addition, the prior art generally fails to provide basic copper nitrate-containing gas generant compositions and related methods

which result in non-gaseous combustion products of a form which permits the removal thereof without requiring removal devices or techniques which are more costly or complicated than otherwise generally desired.

Brief Summary Text (31):
about 40 to about 65 weight percent of a basic copper nitrate oxidizer, and

Brief Summary Text (33):
The invention still further comprehends a method for increasing the burn rate of a gas generant formulation containing a fuel and a basic copper nitrate oxidizer. In accordance with one embodiment of the invention, such method involves including about 0.5 to about 5 weight percent of at least one oxide of a metal selected from the group consisting of Al, Ti, Zn, Mg and Zr in the fuel and basic copper nitrate oxidizer gas generant formulation.

Brief Summary Text (36):
The present invention provides gas generant materials such as may be used in the inflation of inflatable devices such as vehicle occupant restraint airbag cushions. Gas generant materials in accordance with the invention typically include a gas generating fuel component, a basic copper nitrate oxidizer component, a metal oxide burn rate enhancing additive component and, if desired, silica slag formation additive.

Brief Summary Text (41):
In accordance with certain preferred embodiments of the invention, about 40 to about 65 weight percent of the subject gas generant composition constitutes basic copper nitrate oxidizer, with such oxidizer component being effective to oxidize combustion reaction with the associated fuel component.

Detailed Description Text (10):
The results of Examples 1-5, as compared to the results of Comparative Example 1, show the effect of alumina on a basic copper nitrate containing gas generant composition.

Detailed Description Text (13):
As shown by the results for Comparative Examples 2-6, the inclusion of silica in the tested relative amounts of 1.00-5.00 weight percent, while effective to improve the solid slag recovery of the respective basic copper nitrate oxidized compositions upon reaction, generally resulted in the respective compositions displaying significantly reduced burn rates as compared to a similar composition without such silica inclusion (Comparative Example 1). In particular, such burn rate depression was observed with the inclusion of as little as 1.00 weight percent silica. Further, such burn rate depression did not appear to significantly vary with increased silica content.

Detailed Description Text (14):
Thus, although refractive oxides such as silica and alumina have been used in certain gas generant formulations for purposes of slag improvement, it is wholly unexpected that alumina would be effective for the purpose of increasing the burn rate of the subject basic copper nitrate gas generant formulations especially in view of the burn rate depression observed with the inclusion of as little as 1.00 weight percent of the refractive oxide, silica.

Detailed Description Text (15):
Examples 6-9 show the effect of the inclusion of varying amounts of both alumina and silica on a basic copper nitrate containing gas generant composition. These results show that the inclusion of 2.00 to 4.00 weight percent alumina (Examples 7-9) resulted in compositions having increased linear burn rates as compared to similar compositions without alumina (Comparative Examples 2-4). Further, the Example 6-8 inclusion of alumina and silica resulted in compositions wherein 100 percent of the theoretical slag was recovered intact.

Detailed Description Text (26):
In view of the above, it will be appreciated and understood that the invention desirably may, in accordance with at least certain preferred embodiments, provide or permit the greater or more widespread use of basic copper nitrate in gas generant compositions such as via the increased burn rates which may result from the practice thereof. As a result, such compositions may no longer be limited or restricted to those applications wherein faster burn rates are either not required or desired. For example, the compositions of the invention may be better suited for various side impact applications where more immediate generation or supply of inflation gas may be required or desired.

Current US Original Classification (1):
149/45

Current US Cross Reference Classification (1):
149/109.6

Current US Cross Reference Classification (2):
149/61

CLAIMS:

1. A gas generant composition having an increased burn rate, said composition comprising:

a fuel component,

a basic copper nitrate oxidizer component therefor, and

a burn rate enhancing amount of a metal oxide additive component selected from the group consisting of Al.sub.2 O.sub.3, TiO.sub.2, ZnO, MgO and ZrO.sub.2.

10. The gas generant composition of claim 1 wherein said basic copper nitrate oxidizer component is present in a relative amount of about 40 to about 65 composition weight percent.

13. A method for making a gas generant formulation having an increased burn rate, the gas generant formulation containing a fuel and a basic copper nitrate oxidizer, said method comprising:

including about 0.5 to about 5 weight percent of at least one metal oxide selected from the group consisting of Al.sub.2 O.sub.3, TiO.sub.2, ZnO, MgO and ZrO.sub.2 in the gas generant formulation.

19. An ignitable gas generant composition having enhanced burn rate and slag formation characteristics, said composition comprising:

about 30 to about 60 weight percent of a gas generating fuel component comprising guanidine nitrate,

about 40 to about 65 weight percent of a basic copper nitrate oxidizer,

a burn rate enhancing amount of a metal oxide selected from the group consisting of TiO.sub.2, ZnO, MgO and ZrO.sub.2 and

a slag formation enhancing amount of SiO.sub.2.

23. An ignitable gas generant composition having enhanced burn rate and slag formation characteristics, said composition comprising:

about 30 to about 60 weight percent of a gas generating fuel component comprising guanidine nitrate,

about 40 to about 65 weight percent of a basic copper nitrate oxidizer,

a burn rate enhancing amount of Al.sub.2 O.sub.3 and

a slag formation enhancing amount of SiO.sub.2.

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L4: Entry 9 of 16 File: USPT Aug 1, 2000

DOCUMENT-IDENTIFIER: US 6096147 A
TITLE: Ignition enhanced gas generant and method

Brief Summary Text (26):
b) at least one oxidizer selected from the group consisting of alkali metal nitrates, chlorates and perchlorates; alkaline earth metal nitrates, chlorates and perchlorates; CuO; Fe.sub.2 O.sub.3 ; CoO; Co.sub.3 O.sub.4 ; V.sub.2 O.sub.5 ; ammonium nitrate; ammonium perchlorate; basic copper nitrate and mixtures thereof.

Detailed Description Text (17):
In accordance with a preferred embodiment of the invention, the igniter composition is formulated as a dry blend of fuel and oxidizer ingredients having a combustion temperature exceeding approximately 2500 K. Useful igniter composition fuels include B, Si, Al, Ti, TiH.sub.2, Zr, ZrH.sub.2, guanidine nitrate, Mg, Mg/Al alloys and mixtures thereof. Useful igniter composition oxidizers include alkali metal nitrates, chlorates and perchlorates; alkaline earth metal nitrates, chlorates and perchlorates; CuO; Fe.sub.2 O.sub.3 ; CoO; Co.sub.3 O.sub.4 ; V.sub.2 O.sub.5 ; ammonium nitrate; ammonium perchlorate; basic copper nitrate and mixtures thereof. In practice, preferred igniter compositions for use in the practice of the invention contain about 15% to about 40% by weight of such fuels and about 60% to about 85% by weight of such oxidizers.

Detailed Description Paragraph Table (2):
TABLE 2 ______________________________________ Gas Generant Composition Ingredient % by weight ______________________________________ guar gum 5.00 hexammine cobalt (III) trinitrate 73.5 basic copper nitrate 21.5 ______________________________________

Current US Original Classification (1):
149/3

Current US Cross Reference Classification (1):
149/109.6

WEST

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L4: Entry 11 of 16 File: USPT Apr 4, 2000

DOCUMENT-IDENTIFIER: US 6045638 A
TITLE: Monopropellant and propellant compositions including mono and polyaminoguanidine dinitrate

Brief Summary Text (9):
U.S. Pat. No. 5,608,183 discloses a gas generant composition containing amine nitrates and basic copper nitrate and/or cobalt triamine trinitrate. This gas generant composition was produced as an alternative to non-azide gas generant formulations.

Current US Original Classification (1):
149/36

Current US Cross Reference Classification (1):
149/47

Current US Cross Reference Classification (2):
149/62

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L4: Entry 12 of 16 File: USPT Mar 21, 2000

DOCUMENT-IDENTIFIER: US 6039820 A
TITLE: Metal complexes for use as gas generants

Brief Summary Text (63):
In addition, a substance such as guanidine nitrate may also have some oxidizing capacity because of the presence of, for example, the nitrate group. However, the cool burning organic nitrogen compound is not the principle oxidizing agent. It may, however, act as a secondary oxidizing agent or a co-oxidizer together with other oxidizing or co-oxidizing substances noted above such as, for example, basic copper nitrate.

Brief Summary Text (67):
In this preferred embodiment, preferred gas generant compositions comprise cool burning organic nitrogen compounds, and in addition, also comprise: 1) at least one one primary fuel such as a metal complex like, for example, hexamminecoabalt nitrate, Co(NH.sub.3).sub.6 (NO.sub.3).sub.3, which is different than the cool burning organic nitrogen compound, 2) a co-oxidizer such as, for example, basic copper nitrate, Cu.sub.2 (OH).sub.3 NO.sub.3, which is different than the cool burning organic nitrogen compound, and 3) a binder which is preferably a water soluble binder such as, for example, guar gum.

Brief Summary Text (68):
In general, in this preferred embodiment, fuels, co-oxidizers, and binders can be used which have previously been described herein. However, preferred examples of fuels for this preferred embodiment include cobalt ammine complexes, and hexaammincobalt nitrate is particularly preferred. Preferred examples of co-oxidizer include basic metal carbonates, basic metal nitrates, metal oxides, metal nitrates, and metal hydroxides. Basic copper nitrate is particularly preferred. Preferred examples of binders include water soluble or substantially water soluble polymers including gums. Guar gum is particularly preferred.

Brief Summary Text (71):
The cool burning organic nitrogen compound can be used to replace partially the fuel ingredient. In this case, the amount of co-oxidizer can be increased to maintain the desired stoichiometry. This may result in cost savings because, for example, both basic copper nitrate and guanidine nitrate are significantly less costly than hexamminecobalt nitrate. Surprisingly, however, the overall performance of the generant is maintained despite the replacement. The maintenance of overall performance is achieved from a volume perspective because the density of the mixture increases as the relative proportion of basic copper nitrate increases.

Detailed Description Text (72):
A formulation was prepared comprising the following starting ingredients: 1) 72.84 wt. % cobalthexaammine nitrate, 2) 21.5 wt. % basic copper nitrate, 3) 5.0 wt. % guar gum, and 4) 0.66 wt. % carbon.

Detailed Description Text (75):
A formulated blend to be extruded was prepared comprising: 1) 38.75 wt. % basic copper nitrate, 2) 36.38 wt. % hexaaminecobaltnitrate, 3) 19.5 wt. % guanidine nitrate, 4) 5.0 wt. % guar gum, and 5) 0.37 wt. % carbon black. The blend was prepared by mixing the ingredients according to the procedure described in Example 33.

Detailed Description Text (78):
A formulated blend to be extruded was prepared comprising: 1) 40.34 wt. % basic copper nitrate, 2) 37.86 wt. % hexaaminecobaltnitrate, 3) 15.8 wt. % guanidine nitrate, 4) 5.7

wt. % guar gum, and 5) 0.3 wt. % carbon black. The blend was prepared by mixing the ingredients according to the procedure described in Examples 33 and 34. Results comparable to those of Example 34 were expected and obtained.

Current US Original Classification (1):
149/45

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L4: Entry 13 of 16 File: USPT Nov 23, 1999

DOCUMENT-IDENTIFIER: US 5989367 A
TITLE: Particle-free, gas-producing mixture

Brief Summary Text (13):
The compounds known in the art can be used as a combustion moderator. These include transition-metal compounds and soot. The transition-metal compounds can be selected from the group of transition-metal oxides, hydroxides, nitrates, carbonates and organo-metallic compounds of the transition metals. Examples of these are iron oxides, copper oxides, chromium oxides, zinc oxide, copper chromite, basic copper nitrate, zinc carbonate, copper resorcylate and ferrocene. However, the use of soot as a combustion moderator, optionally in a mixture with transition-metal compounds, is preferred since soot is inexpensive and it burns off residue-free, forming CO.sub.2.

Current US Original Classification (1):
149/47

Current US Cross Reference Classification (1):
149/36

Current US Cross Reference Classification (2):
149/76

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L4: Entry 15 of 16 File: USPT Jun 3, 1997

DOCUMENT-IDENTIFIER: US 5635668 A
TITLE: Gas generant compositions containing copper nitrate complexes

Detailed Description Text (8):
A gas generant composition was formulated with cupric bis-ethylenediamine nitrate--35.45 wt % as the fuel and basic copper nitrate (Cu(NO.sub.3).sub.2 .multidot.3Cu(OH).sub.2)--64.55 wt % as the oxidizer. To a mixture of the solids was added water to form a 10% slurry. The slurry was mixed in a Hobart.RTM. mixer and then extruded and spheronized using a Nica.RTM. extruder/spheronizer. The prills thus obtained were dried on a fluid bed drier.

Current US Original Classification (1):
149/45

Current US Cross Reference Classification (1):
149/92

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L4: Entry 16 of 16 File: USPT Mar 4, 1997

DOCUMENT-IDENTIFIER: US 5608183 A
TITLE: Gas generant compositions containing amine nitrates plus basic copper (II) nitrate and/or cobalt(III) triammine trinitrate

Detailed Description Paragraph Table (1):
COMPOSITION GAS YIELD PATENT (wt. %) (M/100 gm) T.sub.c (degK) FILTERABILITY U.S. Pat. No. 4,369,079 K.sub.2 BT/KNO.sub.3 1.3 2381 Poor (45.5/54.5) U.S. Pat. No. 5,139,588 Sr(NO.sub.3).sub.2 /AT/SiO.sub.2 2.3 2571 ok (58.9/33.1/8) U.S. Pat. No. 5,197,758 Zn(AT).sub.2 /Sr(NO.sub.3).sub.2 1.93 1856 Poor (44/56) U.S. Pat. No. 4,993,112 NTO/Sr(NO.sub.3).sub.2 2.5 2844 Poor (38.1/68.9) U.S. Pat. No. 5,467,715 AT/CuO/GuNO.sub.3 & 1.5 1550 Good Sr(NO.sub.3).sub.2 (20/69/6/5) WO95/09825 TAGN/KNO.sub.3 /SiO.sub.2 2.75 2468 Fair (47.3/40.7/12.0) This invention bCN/GuNO.sub.3 2.9 1760 Good (47.87/52.13) This invention bCN/urea nitrate 3.45 1955 Good (17.82/82.18) This invention CoTTN/GuNO.sub.3 3.7 1888 Good (58.1141.9) K.sub.2 BT = potassium salt of bitetrazole; AT = 5aminotetrazole; Zn(AT).sub.2 = zinc salt of 5aminotetrazole; NTO = nitrazolone; GuNO.sub. = guanidine nitrate; bCN = basic copper nitrate; CoTTN = cobalt(III)triammine trinitrate, TAGN = triamino gunidinium nitrate

Current US Original Classification (1):
149/45

Current US Cross Reference Classification (1):
149/36